

What is claimed is:

1. System for modifying fuel pressure in a high-pressure fuel injection system of an internal combustion engine, the system for modifying fuel pressure
5 comprising:

a fuel collection unit configured to store high-pressure fuel therein;

at least one fuel injector configured to supply fuel from the fuel collection unit to the engine; and

means for controlling fuel pressure within the fuel collection unit to a target fuel
10 pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining low engine load.

2. The system of claim 1 further including a vehicle speed sensor producing a vehicle speed signal indicative of road speed of a vehicle carrying said engine;

15 and wherein the means for controlling fuel pressure further includes means for controlling fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the vehicle speed signal indicates that the vehicle is not moving.

20 3. The system of claim 1 further including an engine speed sensor producing an engine speed signal indicative of the rotational speed of the engine;

and wherein the means for controlling fuel pressure further includes means for controlling fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the engine speed signal indicates that the
25 rotational speed of the engine is within a predefined range of engine speeds.

4. The system of claim 1 further including a pressure sensor producing a pressure signal indicative of fuel pressure within the fuel collection unit;

and wherein the means for controlling fuel pressure further includes means for
30 controlling fuel pressure within the fuel collection unit to the target fuel pressure while

maintaining low engine load only while the pressure signal indicates that the fuel pressure within the fuel collection unit is below a fuel pressure limit.

5. The system of claim 1 further including further including:

5 a vehicle speed sensor producing a vehicle speed signal indicative of road speed of a vehicle carrying said engine;

an engine speed sensor producing an engine speed signal indicative of the rotational speed of the engine; and

10 a pressure sensor producing a pressure signal indicative of fuel pressure within the fuel collection unit;

and wherein the means for controlling fuel pressure further includes means for controlling fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the vehicle speed signal indicates that the vehicle is not moving, the engine speed signal indicates that the rotational speed of the engine is within a predefined range of engine speeds and the pressure signal indicates that the fuel pressure within the fuel collection unit is below a fuel pressure limit.

6. The system of claim 1 further including a high-pressure fuel pump responsive to a fuel pump control signal to supply high-pressure fuel from a low-pressure fuel source to the fuel collection unit;

and wherein the means for controlling fuel pressure further includes means for modifying the fuel pump control signal to control the fuel pressure within the fuel collection unit to the target fuel pressure.

25 7. The system of claim 1 wherein the means for controlling fuel pressure includes means for controlling fuel pressure within the fuel collection unit to a target fuel pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining low engine load and while controlling rotational speed of the engine to a target engine speed value.

8. The system of claim 7 wherein the at least one fuel injector is responsive to a fueling command signal produced by the control computer to supply fuel from the fuel collection unit to the engine;

and wherein the means for controlling fuel pressure within the fuel collection unit to a target fuel pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining low engine load and while controlling rotational speed of the engine to a target engine speed value includes means for modifying the fueling command signal to control the rotational speed of the engine to the target engine speed value.

9. The system of claim 1 wherein the means for controlling fuel pressure further includes means for maintaining low engine load by maintaining a vehicle carrying the engine in a stationary position.

10. System for modifying fuel pressure in a high-pressure fuel injection system of an internal combustion engine, the system for modifying fuel pressure comprising:

a fuel collection unit configured to store high-pressure fuel therein;

a fuel injector configured to supply fuel from the fuel collection unit to the engine;

a control structure configured to control the fuel pressure within the fuel collection unit to a target fuel pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining low engine load.

11. The system of claim 10 wherein the control structure includes:

a control computer configured to control fuel pressure within the fuel collection unit and to control engine fueling; and

an auxiliary computer connected in electronic communication with the control computer, the auxiliary computer configured to direct the control computer to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load.

12. The system of claim 10 wherein the control structure includes a control computer configured to control fuel pressure within the fuel collection unit and to control engine fueling, the control computer further configured to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load.

13. The system of claim 10 wherein the control structure is configured to maintain low engine load by maintaining a vehicle carrying the engine in a stationary position.

14. The system of claim 10 further including a vehicle speed sensor producing a vehicle speed signal indicative of road speed of a vehicle carrying said engine; and wherein the control structure is configured to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the vehicle speed signal indicates that the vehicle is not moving.

15. The system of claim 10 further including an engine speed sensor producing an engine speed signal indicative of the rotational speed of the engine; and wherein the control structure is configured to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the engine speed signal indicates that the rotational speed of the engine is within a predefined range of engine speeds.

16. The system of claim 10 further including a pressure sensor producing a pressure signal indicative of fuel pressure within the fuel collection unit; and wherein the control structure is configured to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the pressure signal indicates that the fuel pressure within the fuel collection unit is below a fuel pressure limit.

17. The system of claim 10 further including further including:

a vehicle speed sensor producing a vehicle speed signal indicative of road speed of a vehicle carrying said engine;

an engine speed sensor producing an engine speed signal indicative of the rotational speed of the engine; and

5 a pressure sensor producing a pressure signal indicative of fuel pressure within the fuel collection unit;

and wherein the control structure is configured to control the fuel pressure within the fuel collection unit to the target fuel pressure while maintaining low engine load only while the vehicle speed signal indicates that the vehicle is not moving, the engine speed
10 signal indicates that the rotational speed of the engine is within a predefined range of engine speeds and the pressure signal indicates that the fuel pressure within the fuel collection unit is below a fuel pressure limit.

18. The system of claim 10 further including a high-pressure fuel pump
15 responsive to a fuel pump control signal produced by the control computer to supply high-pressure fuel from a low-pressure fuel source to the fuel collection unit;

and wherein the control structure is configured to modify the fuel pump control signal to control the fuel pressure within the fuel collection unit to the target fuel pressure.

20 19. The system of claim 10 wherein the control structure is configured to control the fuel pressure within the fuel collection unit to a target fuel pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining low engine load and while also controlling engine speed to a target engine speed.

25 20. The system of claim 19 wherein the at least one fuel injector is responsive to a fueling command signal produced by the control computer to supply fuel from the fuel collection unit to the engine;

and wherein the control structure is configured to modify the fueling command
30 signal to control engine speed to the target engine speed.

21. A method for modifying fuel pressure in a high-pressure fuel injection system of an internal combustion engine, the high-pressure fuel injection system including a fuel collection unit storing high-pressure fuel therein and at least one fuel injector supplying fuel from the fuel collection unit to the engine, the method comprising:

5 controlling engine load to within a range of low engine loads; and
 controlling fuel pressure within the fuel collection unit to a target fuel pressure near a maximum allowable fuel collection unit fuel pressure level while maintaining engine load within the range of low engine loads.

10 22. The method of claim 21 further including controlling engine speed to within a range of engine speeds prior to controlling fuel pressure to the target fuel pressure.

15 23. The method of claim 21 wherein the act of controlling engine load to within a range of low engine loads includes maintaining a vehicle carrying the engine in a stationary position.

20 24. The method of claim 21 further including continually executing the act of controlling fuel pressure within the fuel collection unit only while a vehicle carrying the engine is not moving.

25 25. The method of claim 21 further including continually executing the act of controlling fuel pressure within the fuel collection unit only while engine rotational speed is within a predefined range of engine speeds.

30 26. The method of claim 21 further including continually executing the act of controlling fuel pressure within the fuel collection unit only while the fuel pressure within the fuel collection unit is below a fuel pressure limit.